Simulated death enhances learner attitudes regarding simulation

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ABSTRACT

Introduction Despite the widespread use of simulated death in healthcare education, some view it as a controversial learning tool due to potential psychological harm. Others believe that allowing death during simulation enhances participant learning. Sparse data exist in the literature about learner attitudes towards simulated death. Our objective was to establish a link between exposure to simulated death and learner attitudes regarding simulation. Our hypothesis was that exposure to simulated death will positively affect learner attitudes towards simulation.

Methods Anonymous surveys were distributed to participants of simulations conducted by our department from January 2014 to December 2015. Collected survey data included total number of simulation scenarios, exposure to death and participants' views towards simulation afterwards. Participants also rated the simulation on a Likert scale. We compared demographic and simulation data for participants who experienced simulated death versus participants who did not. Exposure to death and clinical level were included as predictor variables in logistic regressions using the simulator experience variables as outcomes.

Results 250 survey responses were analysed. 64% of participants were attendings. 82% of participants experienced death during simulation. The group that experienced simulated death gave significantly higher ratings (4.77 vs 4.50, p=0.004) and a higher percentage of maximum ratings on the Likert scale (83% vs 59%, p=0.0002). More participants who experienced death thought that simulated death could enhance learning (76% vs 59%, p=0.021). When adjusted for training level, those who experienced death in simulation were nearly twice as likely to think that death can enhance learning (p=0.049) and 133% more likely to give the simulation the highest rating (p=0.036).

Conclusions Survey participants who experienced simulated death were more likely to think that death can enhance learning and more likely to give the simulation the highest rating, thereby demonstrating that exposure to simulated death positively affects learner attitudes regarding simulation.

INTRODUCTION

High-fidelity human simulation has become increasingly utilised throughout healthcare. The use of simulation in healthcare has advanced beyond teaching medical knowledge and practising technical skills. Currently, it continues to expand into other aspects of non-technical medical education, including learning how to deal with death during infrequent events,[1] practising end-of-life care[2] and evaluating ethical standards.[3] As healthcare educators find more novel ways to incorporate simulation to train practitioners, the need to address ethical considerations surrounding the use of high-fidelity simulation becomes more germane. One such consideration revolves around whether to allow the simulated patient to 'die' during the simulation exercise. Simulation facilitators have differing philosophies pertaining to simulated death; some never allow the simulator to die, some only allow death to occur when faced by advanced learners and others allow death to occur during any scenario.[4]

Simulation experts have debated the pros and cons of using simulated mortality as an educational strategy.[5–9] Simulation can provide experiences that may not be available in traditional clinical environments.[10] It can allow the learner to experience rare but potentially catastrophic clinical events in order to be better equipped to act appropriately in real life.[11] Simulation can also provide a safe learning environment in which to reflect on mortality and learn from the results of provider actions (or inactions) without actually harming a patient.[10] Simulation can also prepare learners for the emotional shock that may accompany experiencing patient death despite best efforts at resuscitation.[5] On the other hand, the theoretical disadvantages of such a potentially controversial learning tool centre around the possible psychological harm to the learner, which may cause undue stress and detract from the intended learning objectives, invoke feelings of guilt and leave a lasting negative impression of simulation education in general.[4 10]

Experiencing death during simulation is likely to increase the participant's stress level. Evidence from the literature suggests that stress can both enhance and detract from learning. Stress has been shown to enhance learning and memory creation through neurobiological pathways such as cortisol release.[12] The concept of enhanced learning through stress has held true in simulation as well: DeMaria *et al* demonstrated that emotional stressors canincrease participant performance in simulated cardiopulmonary arrest.[13] Likewise, Goldberg *et al* demonstrated enhanced participant learning and improved performance among residents when simulated death as a result of clinician failure was allowed to occur.[11] However, other studies have suggested that emotional stress can detract from one's ability to learn. Fraser *et al* demonstrated that death during simulation can lead to a negative emotional response and reduced learning outcomes.[14] Taken

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Table 1 Comparison of subjects who experienced death during simulation versus subjects who did not experience death during simulation

Simulation survey responses	Experienced death (n=204)	Did not experience death (n=46)	p Value
Average number of scenarios	5.52	5.07	0.378
Average number of deaths	3.37	0	n/a
Rating	4.77	4.50	0.004
Gave simulation maximum rating (5 of 5)	83.3%	58.7%	<0.001
Thought death can enhance learning	75.5%	58.7%	0.021
Found simulation helpful	98.5%	97.8%	0.731
Thought simulation would change practice	91.7%	87.0%	0.318

together, these studies may suggest that while a proper amount of stress may enhance learning, too much stress may overwhelm the learner and have the opposite effect. Thus, the debate surrounding simulated death not only centres around whether or not it should be used, but also the best approaches to achieving a delicate balance to foster learning while minimising the negative impact that stress can have on emotional and psychological well-being.

The debate surrounding the ethical considerations of, and best approaches to, using simulated mortality requires more data regarding learners' actual attitudes and reactions toward simulated death. Our knowledge about how experiencing simulated death actually impacts participants remains limited. More empirical studies can either confirm or refute experts' theoretical concerns about simulated mortality. In addition, it can guide the search for the optimal approach to maximise learning while minimising potential psychological harm.[5] Thus, our objective for this current study was to determine if there exists a link between learners' exposure to simulated death and subsequent attitudes regarding simulation. Our hypothesis was that exposure to simulated death will enhance participants' attitudes regarding simulation.

METHODS

Exemption was granted from the Mount Sinai Programme for the Protection of Human Subjects for the need for written consent. Anonymous surveys were distributed to all participants of full environment simulations from January 2014 to December 2015 at the conclusion of their simulations. All participants were given the opportunity to opt out of taking the survey, and participation in the survey was considered consent to the study. All simulation scenarios took place at the Human Emulation, Educational and Evaluation Lab for Patient Safety and Professional Study Simulation Centre in the Department of Anesthesiology at the Icahn School of Medicine at Mount Sinai. Survey participants comprised anaesthesiology attendings, anaesthesiology residents and medical students; participants below the medical student level were excluded from the survey. Surveys were conducted immediately following simulation sessions and were completed only once by each respondent. Demographic data collected included participants' clinical level and number of years in practice. For the simulation session immediately preceding the survey, data were collected for exposure to simulated death, whether the participant thought the simulation was helpful, whether the participant thought the simulation would cause a change in practice and whether the participant thought that simulated death can enhance learning. Participants were also asked to rate the simulation experience on a Likert scale (1–5).

Demographic and simulation data were compared for the group that was exposed to simulated death versus the group that was not exposed to simulated death. A series of logistic regressions were performed using clinical level and exposure to death as predictor variables and each simulator experience variable as the outcome. All statistical analyses were performed using SAS statistical software (SAS Institute, Cary, North Carolina, USA).

RESULTS

Of the 250 survey participants included in the study, 160 (64%) were anaesthesiology attendings and 90 were in medical training at time of the survey. Participants reported undergoing an average of 5.44 simulation scenarios per each session. Two hundred and four participants (82%) were exposed to death during their simulation session, and 46 (18%) were not. Simulation experience characteristics of survey participants are reported in table 1.

Participants who were exposed to death gave the simulation session a significantly higher rating on average (4.77 vs 4.50, p=0.004). Also, a significantly greater percentage of the group experiencing death rated the simulation session a maximum 5 out of 5 rating (83.3% vs 58.7%, p<0.001). A significantly greater percentage of the participants who were exposed to death thought that simulated death can enhance learning (75.5% vs 58.7%, p=0.021). There were no significant differences in whether participants thought the simulation was helpful and whether they thought the simulation experience would change their practice. No participants reported trauma from experiencing the simulated mortality nor sought counselling or assistance afterwards.

Multivariate logistic regression analysis (table 2) yielded significant models for whether participants thought simulated death can enhance learning and whether participants gave the simulation the maximum rating. When adjusted for training status, participants who were exposed to death were more likely to think that simulated death can enhance learning (OR 1.994; 95% CI 1.003 to 3.963) and to rate the simulation a maximum 5 out of 5 rating (OR 2.325; 95% CI 1.058 to 5.107).

DISCUSSION

Despite much debate on the theoretical psychological and educational impact of death during simulation scenarios, there is limited evidence in the literature about participants' actual

Table 2 Logistic regression models for predictors of simulator experience outcomes

Simulator experience outcome*†	Predictor variable	OR	95% CI	p Value	Coefficient	SE
Thought that death can enhance learning	Exposed to death	1.994	1.003 to 3.963	0.049	0.690	0.350
Gave simulation maximum rating (5 out of 5)	Exposed to death	2.325	1.058 to 5.107	0.036	0.844	0.402

*Regression models were not significant for the following outcomes: found simulation helpful; thought simulation would change practice.
†Regression models were adjusted for training level.

attitudes towards encountering simulated mortality. A review by Heller *et al* concluded that the majority of prospective studies found that death in the simulator, while stressful, could have a positive impact on learners.[15] However, the review also noted limitations, which included small sample sizes limited to trainees, and evaluations in group settings in which participants might not fully disclose their thoughts. Some studies did not directly compare groups that did and did not experience simulated mortality, but rather collected open-ended survey responses from all participants.[8 16 17]

In our study, we compared survey responses about simulated mortality from participants who were directly exposed to simulated death versus those who were not. Our study design allowed for a comparison of responses from a relatively large sample size of participants of various clinical levels. Notable was the inclusion of attendings who were undergoing simulation for continuing professional development. Nearly all of the evidence related to simulated mortality is limited to trainees; to our knowledge, our study is the first to compare survey responses of attendings who have completed their clinical training. Since faculty are expected to teach and supervise trainees and other medical personnel during emergent medical situations that may involve death, simulation scenarios that involve mortality may provide them with opportunities to hone their communication and decision making in preparation for such events. Our results provided evidence that participants were likely to respond well to encountering death during simulation and rated the experience more favourably than those who were not given that opportunity.

Our study does have a few limitations. First, participants were not randomised to the group that experienced death or the group that did not experience death during simulation. However, since all participants were surveyed regardless of what simulations they encountered, we believe this would create a heterogeneous study population to overcome the lack of randomisation. Second, participants experienced scenarios that were not identical and may not even have been similar in nature. It is possible that the simulations provided to the death group tended to be more favourable or well received than the ones provided to the non-death group and therefore received better evaluations. Similarly, since different combinations of faculty instructors led different simulation sessions throughout the study period, it may be possible that the faculty in the death group tended to be more favourable than in the non-death group. With that said, since we provide dozens of scenarios and our faculty is limited to eight instructors, we believe that there was sufficient randomisation of the scenarios given by the limited number of instructors, to the point that neither of these factors would influence our findings to a significant degree. Third, our simulation participants were limited to anaesthesiology providers. Because the majority of our department's simulation centre's participants are anaesthesiology attendings, anaesthesiology residents and students interested in anaesthesiology, this specific population was more accessible for our surveys. While our study was well represented by both trainees and non-trainees in our specialty, the inclusion of subjects from other specialties would strengthen the argument that experiencing simulated death can enhance learning in a simulation environment, regardless of clinical background and training.

There remains much that needs to be investigated regarding how simulated death impacts a learner's experience. Our study's findings and limitations have yielded some ideas for future directions in this topic. First, randomised controlled studies involving participants of various clinical levels at different institutions are critical to further establish that simulated death can enhance learning and garner positive reactions regarding simulation. In particular, these studies should extend to subjects from various specialties to test the hypothesis that simulated mortality can truly enhance the learning of all participants. Finally, incorporating standardised scenarios would not only ensure that randomised groups will be compared appropriately, but also provide opportunities to test the nuances of how learners perceive and respond to death during simulation. Will learners respond differently to death if it occurs as a consequence of choices they made during simulation than if it occurred despite providing appropriate care? Will learners still believe that experiencing death during simulation enhances their learning if it occurs repeatedly, or is there a ceiling effect? Answering such questions through the use of standardised scenarios and carefully planned study groups can help determine the optimal approach to maximise the benefits of experiencing death in a simulator environment while minimising any potential harm.

In our study, we illustrated that participants who experienced simulated death were more likely to think that it can enhance learning and were more likely to give the simulation the highest rating, regardless of training level. To our knowledge, ours is the only study comparing close-ended survey responses of simulation participants of various clinical levels that demonstrated that exposure to simulated death positively affects learner attitudes regarding simulation. We believe our findings can serve as empiric evidence that using simulated mortality as an educational tool is beneficial and may suggest that the proposed critiques against it are not manifested in actual simulation practice.

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Competing interests None declared.

Ethics approval Exemption was granted from the Mount Sinai Program for the Protection of Human Subjects for the need for written consent because we collected anonymous survey responses that did not contain any personal medical information.

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Data sharing statement Additional unpublished data from the study include the individual anonymous survey responses. The data are currently stored at the Icahn School of Medicine at Mount Sinai and can be obtained with the authors' permission.

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